policy. Marine life is treated with the advantage of very recent researches; but we doubt if irregular echinoderms are rightly styled "old-fashioned." Is not the author thinking of the extinct but regular Palæozoic forms? The illustrations of carnivores from paintings by W. Walls are the finest in a most interesting book. Teachers of geography and lovers of animal life will alike rejoice in it.

(5) Mr. Howarth has undertaken a hard task in giving a compressed picture of the commercial activity of the world. Such a work, however well done, cannot help reminding us of the lists of capes and rivers that once posed as lessons in geography. It is impossible to correlate all the details with the physical conditions of the country which they concern. The excellent description of the industries of Sheffield (p. 95) shows what the author would give us in a more limited field or in a series of such volumes. Even among the mere statements of facts, such as "*Zinc* is an important mineral product of Germany, Belgium, the United States, and elsewhere," he hits upon something that makes us think; why, for instance, are precious stones "in great part products of hot countries"?

GRENVILLE A. J. COLE.

TEXT-BOOKS OF PHYSICS.

(1) *Mechanics and Heat: an Elementary Course of Applied Physics.* By J. Duncan. Pp. xiii + 381. (London: Macmillan and Co., Ltd., 1913.) Price 3*s.* 6*d.*

(2) *Experimental Science.* I., Physics. By S. E. Brown. Pp. viii + 272. (Cambridge: University Press, 1913.) Price 3*s.* 6*d.*

(3) *Practical Physics for Secondary Schools.* By N. H. Black and Dr. H. N. Davis. Pp. ix + 487. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 5*s.* 6*d.* net.

(4) *A Text-book of Physics.* Edited by A. Wilmer Duff. Third edition revised. Pp. xvi + 686. (London: J. and A. Churchill, 1913.) Price 10*s.* 6*d.* net.

(5) *A Systematic Course of Practical Science for Secondary and other Schools.* Book II., Experimental Heat. By A. W. Mason. Pp. vii + 162. (London: Rivingtons, 1913.) Price 2*s.* 6*d.* net.

(6) *Paul Drudes Physik des Aethers auf Elektromagnetischer Grundlage.* Zweite Auflage. Neu bearbeitet von Dr. Walter König. Pp. xvi + 671. (Stuttgart: F. Enke, 1912.)

(1) THE object of Mr. Duncan's text-book, according to the preface, is to awaken interest in the applications of the principles of mechanics and heat to engineering and allied constructive arts. The author has compiled a well-arranged course of experimental work and descriptive matter in mechanics and heat, and, being an engineer, the applied side of the subject is kept well in the foreground. The first eleven chapters are devoted to mechanics, and contain, in addition to the more or less academic part of the subject, chapters on simple mechanism and hydraulic machines. The remaining ten chapters deal with heat, the action of the steam engine and the internal combustion engine being presented in a very simple and lucid manner, and well illustrated by clear diagrams. It may be regretted that Mr. Duncan could not have included some of the more modern methods of thermometry in the section on temperature, the principles and construction of many of the instruments employed being quite intelligible to elementary students. The subject of thermal conductivity, too, is barely touched upon, and as lagging is of extreme importance to the engineer, the value of the book would have been considerably increased by the inclusion of a few well-chosen experiments on this subject.

The book can be strongly recommended to first year students in technical institutes, and there is much in it that the average boy in the upper forms of a secondary school will appreciate. His interest in physics will certainly be stimulated by having the action of the cycle-motor and the motor-car engine so lucidly explained. Teachers of physics in schools may, however, object to the use of British units—lb., ft., ° F.—and the physicist does not usually determine the latent heat of water by plunging a piece of ice weighing $\frac{1}{2}$ lb. in $\frac{1}{2}$ gall. of water. Objection may also be made to this constant being termed the latent heat of ice. An excellent feature of the book is the questions and exercises appended to each chapter.

(2) The volume on physics by S. E. Brown is the first part of a course on experimental science for use in secondary schools; part ii. is to deal with chemistry. The present book is divided into four sections, viz., (1) measurement, (2) hydrostatics, (3) mechanics, (4) heat. The author supposes a boy to spend from two to three years in working through the book, and this, in conjunction with the chemistry course, should prepare him fully for such examinations as the experimental science of the Junior Locals or the Army Qualifying Examinations. As is now usual in books of this character, the manual may be used either in the laboratory or the class-room. The experiments are well selected, and great care has been taken in the preparation of the volume. We do not, however, like such statements as that on p. 3, where, in explaining how to use a scale for measuring lengths, we have the direction: "Put

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one end of the object to be measured exactly opposite to the first unit mark"; the position of both ends of the object should be read off, the fraction of a division being estimated by the eye. We cannot agree with the author's claim on p. 194 that the apparatus described for measuring the expansion-coefficient of air at constant pressure gives better results than any form usually employed in schools. He has in the example cited a movement of the mercury column of 4·93 cm., and it would be very difficult to estimate this exactly to more than 1 mm. There is confusion in the definition of thermal conductivity, the expression "a centimetre cube" would have been better than "a cubic centimetre," and the coefficients of thermal conductivity in the table on p. 245 are not in calories. The large number of questions and numerical exercises should prove a great boon to many teachers.

(3) "Practical Physics for Secondary Schools," by Black and Davis, is not a laboratory manual, but what in England would probably be termed a "Text book of Elementary Physics." The authors, in the preface, state that in preparing the volume they have tried to select only those topics which are of vital interest to young people, whether or not they intend to continue the study of physics in a college course. They believe that everyone needs to know something of the working of electrical machinery, optical instruments, automobiles, vacuum cleaners, fireless cookers, &c. It must not be thought, however, that the fundamental principles of physics have been neglected; Messrs. Black and Davis have succeeded in producing a very clear and interesting textbook. In the chapters devoted to optics we have the proof of the mirror formula, $1/D_0+1/D_1=1/f$, but in the case of the lens the authors state the same formula holds. We should like to have seen it made more explicit as to the signs of the terms in the various cases which may arise. Fig. 444, combining spectral colours into white light by aid of a convex lens, is obviously wrong. The book contains a large number of questions and numerical exercises, and there is much useful information in it which should prove of extreme value to a teacher, but it is scarcely suitable for adoption in English schools owing to its American style.

(4) The first edition of Duff's "Text-book of Physics" appeared in 1908, and was compiled by the collaboration of seven teachers of physics in the universities and polytechnic institutes of the United States. In this third edition the sections on heat and electricity and magnetism have been re-written, and are greatly improved. Prof. Mendenhall is responsible for the section on heat, and Prof. Carman for that on electricity and magnetism. Prof. McClung contributes a section on the conduction of electricity through gases. The text-book forms an excellent college course on physics, and though, in a single volume, the treatment of some points must of necessity be meagre, there are references at the ends of each section to the various standard text-books dealing with special branches.

(5) "Experimental Heat," by A. W. Mason, is a laboratory course of experiments for secondary schools, and thoroughly covers the syllabus of the Matriculation and Senior Locals. The book is well arranged, and each exercise is furnished with questions bearing on it. The answering of these by the pupil will certainly necessitate intelligent thought about the experiment he has performed.

(6) It is more than eighteen years since Drude's "Physik des Aethers" was published, the book being the outcome of a course of lectures on Maxwell's Electromagnetic Theory delivered by the late Prof. Drude at the University of Göttingen. Although the book did not aim at being a complete treatise on electricity and magnetism, it formed an excellent introductory course to the standard work of Maxwell. The mathematical treatment was simple, no further knowledge than the elements of the calculus and differential equations being demanded of the reader. In the new edition by Prof. W. König, although the scope of the book remains the same, considerable modifications have been made which greatly enhance its value as a text-book of electricity. The first portion of this second edition is devoted to electrostatic theory, the treatment of which was exceedingly meagre in Drude's original work. The section dealing with Helmholtz's "Action at a distance" theory has been omitted, and also the chapters bearing on optical phenomena from the electromagnetic point of view. These latter have been treated by Drude at much greater length in his more recent "Lehrbuch der Optik." The chapters on electrical oscillations have been amplified, the theory of coupled circuits being included. The author has found it impossible to deal with the electron theory within the compass of the book. An excellent portrait of the late Prof. Drude forms the frontispiece of the work.

OUR BOOKSHELF.

Underground Waters for Commercial Purposes. By Dr. F. L. Rector. Pp. v+98. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1913.) Price 4*s*. 6*d*. net.

THE title of this book is rather misleading. Although the contents are interesting and useful so far as they go, the book cannot in any way be regarded as a text-book for those engaged in

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